

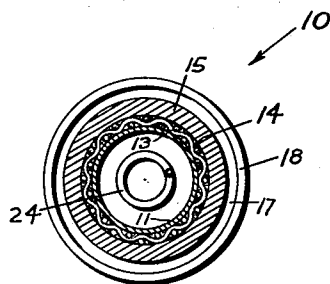
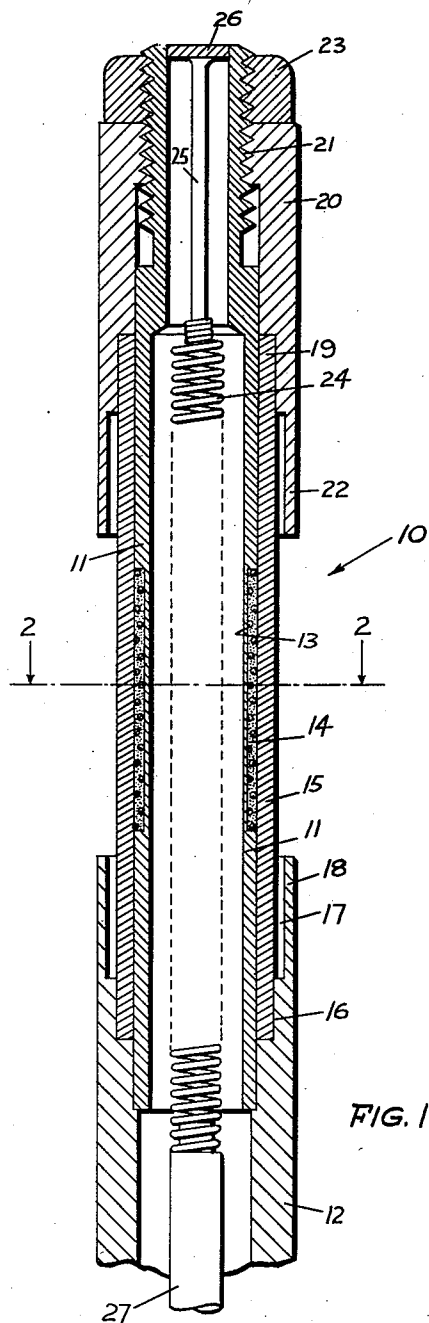
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INDIRECTLY-HEATED CATHODES

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INDIRECTLY-HEATED CATHODES

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This invention relates to electron discharge devices and more particularly to cathodes of the indirectly-heated type which may be used in electron discharge devices.

Indirectly-heated cathodes having a reservoir of electron-emissive material positioned beneath a porous tungsten surface are well known. This invention relates to an improvement in the reservoir type cathode, but is not necessarily limited thereto.

Specifically, this invention discloses that the reservoir of electron-emissive material may be made of a metallic mesh with the electron-emissive material packed into the spaces between the mesh. The mesh, which may be made, for example, of molybdenum, is attached to a central support member and is in substantial contact with the porous member which covers the reservoir. By the use of this structure, the electron-emissive material in the reservoir will be firmly held during assembly of the device and will be uniformly activated during processing of the device due to even conduction of heat to all regions of the reservoir by means of the metallic mesh. Furthermore, heat may be uniformly transferred from the central support member to the porous tungsten member covering the reservoir by means of the metallic mesh so that the exterior surface of the cathode is maintained at a substantially uniform heat. This reduces the possibility of localized heating attendant upon localized production of gas, which increases localized back bombardment of the cathode, particularly in high voltage devices, such as magnetrons.

This invention further discloses a lock nut arrangement whereby the cathode end shields may be locked on to the base support member, thereby rigidly holding the porous tungsten member with respect to the base support member and the reservoir.

Other objects and advantages of this invention will become apparent as the description thereof progresses, reference being had to Figs. 1 and 2, wherein:

Fig. 1 illustrates a longitudinal cross-sectional view of a cathode embodying this invention; and

Fig. 2 illustrates a transverse cross-sectional view of the device shown in Fig. 1 taken along line 2—2 of Fig. 1.

Referring now to Figs. 1 and 2, there is shown a cathode structure 10 comprising a base support cylinder 11, which is rigidly attached at its lower end to a lead-in support member 12, which is adapted to be sealed by means of an insulating seal, not shown, through the wall of an electron discharge device. The outer surface of support cylinder 11 has a cylindrical recess therein for a substantial distance along the longitudinal dimension thereof. Positioned in the recess in member 11 is a wire mesh 13 which is attached to support cylinder 11 as, for example, by sintering. The spaces in wire mesh 13 are filled with an electron-emissive material 14, which may be, for example, originally barium carbonate, which, upon heating, breaks down to electron-emissive barium oxide during activation of the cathode.

It is to be clearly understood that any desired electron-

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emissive material may be used in place of the barium carbonate 14. The barium carbonate 14 is preferably applied to the mesh 13 as a paste during assembly of the device, but other methods may be used if it is so desired.

Surrounding base cylinder 11 and the mesh 13 is a cylindrical member 15, which may be made, for example, of porous tungsten. As shown here, the member 15 engages the mesh 13 and the member 11 beyond the ends of the recess containing mesh 13. The member 15 may be produced, for example, by sintering powdered tungsten in a mold or by any other desired means. Furthermore, other porous metals could be used for member 15, such as porous molybdenum or porous tantalum. Member 15 is rigidly held with respect to member 11 by engaging at its lower end a recess 16 in lead-in member 12. A larger recess 17 in member 12, positioned above the recess 16, produces a cylindrical extension 18 of lead-in member 12 which extends upwardly along member 15, spaced therefrom, to a point somewhat below the lower edge of the recess in member 11 containing the mesh 13. The extension 18 would be used as a cathode end shield in a magnetron and would be positioned just below the lower edge of the anode members to prevent any substantial motion of the electrons in a direction axial to the cathode.

The upper end of porous member 15 engages a recess 19 in an upper end shield member 20, which threadedly engages base support cylinder 11 as at 21. An extension 22 of shield member 20 extends downwardly around porous cylindrical member 15 spaced therefrom to a point somewhat above the upper edge of the recess in member 11 which contains the mesh 13. Extension 22 would act as the upper end shield proper if the cathode were used in a magnetron and would terminate at a point slightly above the upper edge of the anode members. A lock nut 23 is provided, which threadedly engages member 11 and bears against the upper edge of end shield 20, thereby locking the cathode assembly together. A heater coil 24 is provided within cylinder 11, which is hollow. The heater coil 24 is shown here by way of example only, and any desired means for heating the cathode may be used. The upper end of the heater coil 24 is rigidly attached as by welding to a rod 25, which, in turn, is rigidly attached as by welding through plug 26 to the upper end of cylinder 11. The lower end of heater coil 24 is welded to a heating rod 27 which extends downwardly through lead-in cylinder 12 spaced therefrom and through an insulating seal, not shown. By application of a potential between lead-in rod 27 and lead-in member 12, current may be caused to flow through heater coil 24, thereby heating the coil 24. The heat from coil 24 is, in turn, radiated to support cylinder 11 which transfers the heat by conduction through the mesh 13 to the electron-emissive material 14 and the porous tungsten cylinder 15. The electron-emissive material 14 slowly diffuses through the porous cylinder 15, thereby creating a condition on the surface of porous cylinder 15 which will cause copious emission of electrons. When such a device is constructed with barium carbonate as the electron-emissive material, good results may be obtained with the cathode heated to a temperature of approximately 1000° C.

This completes the description of the embodiment of the invention illustrated herein. However, many modifications thereof will be apparent to persons skilled in the art without departing from the spirit and scope of the invention. For example, the support member 11 and porous member 12 need not necessarily be cylindrical and the device could be used without end shields, if so desired. Accordingly, it is intended that this invention be not limited to the particular details of the embodiment of the invention disclosed herein, except as defined by the dependent claims.

What is claimed is:

1. An indirectly-heated cathode comprising a support member, a wire mesh covering the surface of said member, electron-emissive material substantially filling the spaces in said mesh, a porous member covering said mesh, and an end shield covering one end of said porous member and threadedly attached to said support member, and a lock nut threadedly engaging said support member and bearing against said end shield. 5
2. An indirectly-heated cathode comprising a metallic support cylinder, a mesh covering the surface of said member and attached thereto, electron-emissive material comprising barium substantially filling the spaces in said mesh, a porous tungsten cylinder member covering said mesh in substantial contact therewith, a heater positioned with- 10 15

in said cylinder, an end shield covering one end of said porous cylinder and threadedly attached to said support cylinder, and a lock nut threadedly engaging said support cylinder and bearing against said end shield.

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